



TENNESSEE DEPARTMENT OF

**EDUCATION**  
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## Principles of Agricultural Mechanics

<b>Primary Career Cluster:</b>	Agriculture, Food and Natural Resources
<b>Consultant:</b>	Steven Gass, (615) 532-2847, <a href="mailto:Steven.Gass@tn.gov">Steven.Gass@tn.gov</a>
<b>Course Code(s):</b>	TBD
<b>Prerequisite(s):</b>	Agriscience
<b>Credit:</b>	1
<b>Grade Level:</b>	10
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Agriculture courses.
<b>Programs of Study and Sequence:</b>	This is the second course in the <i>Agricultural Engineering and Applied Technologies</i> program of study.
<b>Necessary Equipment:</b>	Refer to the Teacher Resources page below.
<b>Aligned Student Organization(s):</b>	FFA: <a href="http://www.tnffa.org">http://www.tnffa.org</a> Allie Ellis, (615) 253-5207, <a href="mailto:Allie.Ellis@tn.gov">Allie.Ellis@tn.gov</a>
<b>Supervised Agricultural Experience and/or Coordinating Work-Based Learning:</b>	All Agriculture students are encouraged to participate in a Supervised Agricultural Experience (SAE) program. In addition, if a teacher has completed work-based learning training, he or she can offer appropriate placement. For more information, please visit <a href="http://www.tn.gov/education/cte/wb/">http://www.tn.gov/education/cte/wb/</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no statewide dual credit/dual enrollment opportunities for this course. If interested in establishing, reach out to your local postsecondary institution.
<b>Teacher Endorsement(s):</b>	048, 448
<b>Required Teacher Certifications/Training:</b>	No
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/AgricultureFoodNaturalResources.shtml">http://www.tn.gov/education/cte/AgricultureFoodNaturalResources.shtml</a>

### Course Description

*Principles of Agricultural Mechanics* is a course introducing students to basic skills and knowledge in construction and land management for both rural and urban environments. This course covers topics including project management, basic engine and motor mechanics, land surveying, irrigation and drainage, agricultural structures, and basic metalworking techniques. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects, Tennessee Common Core State Standards for Mathematics, and National Agriculture, Food, and Natural Resources Career Cluster Content Standards.\*

## Program of Study Application

This course is the second course in the *Agricultural Engineering and Applied Technologies* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Agriculture, Food, and Natural Resources website at <http://www.tn.gov/education/cte/AgricultureFoodNaturalResources.shtml>.

## Course Standards

### Safety

- 1) Identify the benefits of knowing and applying basic safety procedures in both an agricultural laboratory and workplace. Interpret current Occupational Safety and Health Administration (OSHA) guidelines to conduct a compliance review of the agricultural laboratory, including a written summary justifying the findings with recommendations for improving the safety of working conditions. (TN CCSS Reading 1, 2; TN CCSS Writing 1, 4, 7, 9)
- 2) Review common laboratory safety procedures for tool and equipment operation in the agricultural mechanics laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures in a lab setting and complete a safety test with 100 percent accuracy. (TN CCSS Reading 3)

### Project Management

- 3) Outline the basic principles and procedures of effective project planning. Create and present a project plan for an agricultural mechanics project or a supervised agricultural experience program related to agriculture mechanics. (TN CCSS Reading 2; TN CCSS Writing 4)
- 4) Using industry-specific terminology, identify components for preparing a budget and cost estimate. Develop a budget using a scaled drawing or blueprint to construct or repair an agriculture mechanics project. (TN CCSS Reading 1, 7; TN CCSS Writing 8; TN CCSS Math N-Q, s-SSE)

### Engine and Motor Mechanics

- 5) Compare and contrast the chief features, functions, and applications of two-cycle engines, four-cycle engines, and electric motors. Citing technical references, recommend a maintenance schedule specific to the working environment (such as indoor/outdoor conditions, exposure to heat or cold) of the engine and/or motor. Conduct the appropriate maintenance with adherence to specifications outlined in the schedule. (TN CCSS Reading 1, 2; TN CCSS Writing 2, 4, 7, 8, 9)
- 6) Identify and differentiate between the different types of fuel and power sources used in conjunction with engines and motors. Recommend the types and sizes of engines/motors best suited for a range of applications. Provide a written justification, citing specific textual evidence, to support the recommendation. (TN CCSS Writing 1, 7, 9)



## **Surveying**

- 7) Using topographical maps and appropriate mathematical equations, determine the acreage of a specific plot of land. Document and defend the methods used to arrive at the result, annotating calculations and field notes in a manner easily retrieved by other readers. (TN CCSS Reading 3, 4; TN CCSS Writing 4, 7; TN CCSS Math N-Q, G-CO, G-MG)
- 8) Apply precision surveying processes and geographic information system (GIS) technology to calculate the acreage of a specific plot of property. Using field notes and digital data (such as GIS overlays), develop a written survey report of the designated plot to include, at minimum, measurements, degrees, markers, and other notable geographic parameters. (TN CCSS Reading 3, 7; TN CCSS Writing 2, 7, 9; TN CCSS Math N-Q, G-CO, G-MG)

## **Irrigation and Drainage**

- 9) Analyze the interrelationships among plants, water, air, and soil to maximize the health and productivity of agricultural crops. Calculate the permeability rate, available water holding capacity, pH levels, and nutrient levels for a specific soil type. (TN CCSS Reading 4; TN CCSS Math N-Q, F-BF)
- 10) Apply physics concepts governing various pumping systems and delivery options to achieve the optimum irrigation and drainage required for row crop, greenhouse, and nursery operations in various soil-plant-climate combinations. Develop irrigation schedules to satisfy the design daily irrigation requirements (DDIR) for specific crops, citing specific textual evidence. (TN CCSS Reading 1; TN CCSS Writing 4; TN CCSS Math N-Q, A-CED, F-BF)
- 11) Compare and contrast irrigation methods for row crops, attending to such factors as water conservation, efficiency, and cost. Investigate and document findings on the effectiveness and efficiency of a surface irrigation versus a drip irrigation method, developing claim(s) and counterclaim(s) for scenarios in which each method would be most applicable. (TN CCSS Reading 1; Writing 1, 7, 9; TN CCSS Math N-Q, F-IF)

## **Agricultural Structures**

- 12) Interpret plans and working drawings to select appropriate building materials for a given agricultural structure. Using correct units and measurements, draft a written bill of materials enumerating the quantities of each selection, including but not limited to concrete, masonry, wood, metal, and composite materials. (TN CCSS Reading 3, 4, 5; TN CCSS Writing 2, 4, 9; TN CCSS Math N-Q, A-REI, G-MG)
- 13) Applying construction principles pertaining to wood, concrete, metal, masonry, plumbing and electricity construct or repair an agricultural structure according to prescribed working plans. (TN CCSS Reading 3, 7; TN CCSS Math N-Q, G-MG)

## **Agricultural Metalworking**

- 14) Compare and contrast the physical and chemical properties of arc welding, metal inert gas (MIG) welding, gas welding, soldering, and brazing. Demonstrate the ability to precisely follow



operational and safety procedures for each fusion process across various applications. (TN CCSS Reading 3)

- 15) Classify the physical and chemical properties associated with various metal-cutting methods. Demonstrate adherence to operational and safety procedures for using oxy-fuel or plasma in applications involving mild steel, copper, sheet metal, and cast iron. (TN CCSS Reading 3)
- 16) Select and demonstrate the best method to construct, connect, or repair metallic and non-metallic materials for a variety of agricultural applications, including but not limited to plumbing, sheeting, and equipment. (TN CCSS Reading 3)

## Standards Alignment Notes

\*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to demonstrate fluency in Standards 6, 9, and 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to demonstrate fluency in Standards 3, 5, and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#); Math Standards for High School: Number and Quantity, Algebra, Functions, Geometry, Statistics and Probability (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project-based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, algebraic, functional, geometric, statistical reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- AFNR: [National Agriculture, Food and Natural Resources \(AFNR\) Career Cluster Content Standards](#). Students engaged in activities outlined above should be able to demonstrate fluency in Standards in CS, PST, ABS, NRS, ESS, and PS systems at the conclusion of the course.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

